

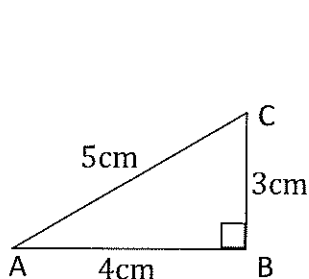
### The Primary Trigonometric Ratios

The triangles shown below are all similar.

What does it mean if triangles are similar? *They have the same shape. (ie. the angles are equal)*

Recall: Similar triangles aren't always right triangles. We will focus on right triangles because they have some special properties.

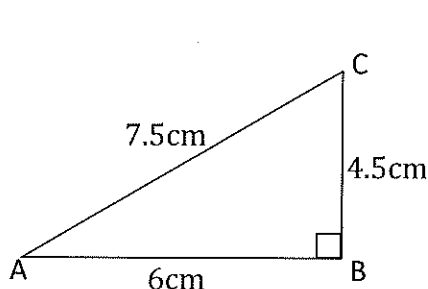
The side lengths have all been given, find the ratios of AB to BC, BC to AC and AC to AB.



$$\frac{AB}{BC} = \frac{4}{3} = 1.\bar{3}$$

$$\frac{BC}{AC} = \frac{3}{5} = 0.6$$

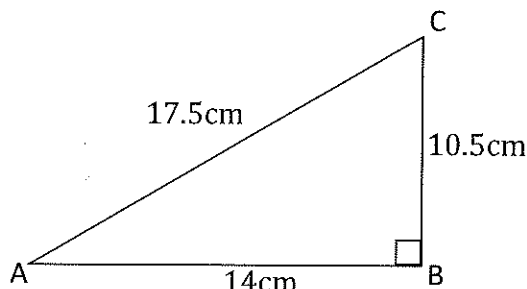
$$\frac{AC}{AB} = \frac{5}{4} = 1.25$$



$$\frac{AB}{BC} = \frac{6}{4.5} = 1.\bar{3}$$

$$\frac{BC}{AC} = \frac{4.5}{7.5} = 0.6$$

$$\frac{AC}{AB} = \frac{7.5}{6} = 1.25$$



$$\frac{AB}{BC} = \frac{14}{10.5} = 1.\bar{3}$$

$$\frac{BC}{AC} = \frac{10.5}{17.5} = 0.6$$

$$\frac{AC}{AB} = \frac{17.5}{14} = 1.25$$

What do you notice about the ratios?

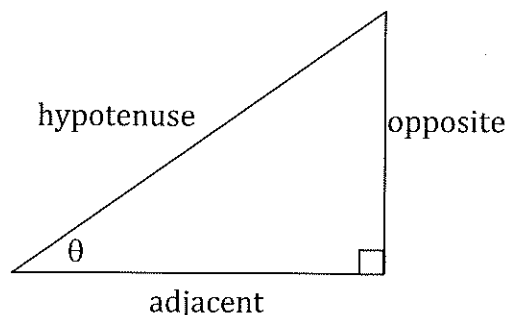
#### The Trigonometric Ratios

If angle  $\theta$  is an acute angle in a right triangle, then

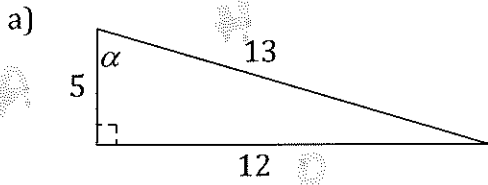
$$\sin \theta = \frac{\text{length of the side opposite } \angle \theta}{\text{length of the hypotenuse}}$$

$$\cos \theta = \frac{\text{length of the side adjacent to } \angle \theta}{\text{length of the hypotenuse}}$$

$$\tan \theta = \frac{\text{length of the side opposite } \angle \theta}{\text{length of the side adjacent to } \angle \theta}$$



Example:

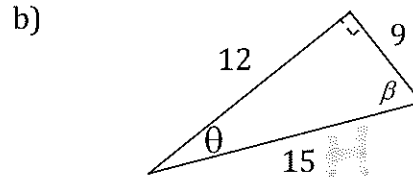


Find the length of the side that is:

The hypotenuse: 13

Adjacent to  $\alpha$ : 5

Opposite to  $\alpha$ : 12



Find the length of the side that is:

The hypotenuse: 15

Opposite to  $\theta$ : 9

Adjacent to  $\beta$ : 9

Opposite to  $\beta$ : 12

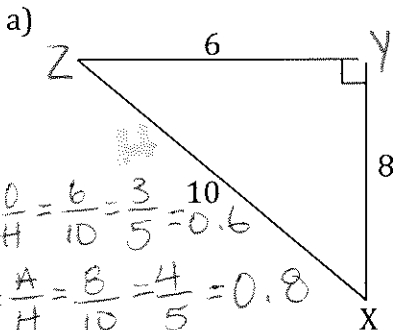
## SOHCAHTOA

$$\sin\theta = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\tan\theta = \frac{\text{opposite}}{\text{adjacent}}$$

Example: Define the sine, cosine and tangent ratios for  $\angle X$  and  $\angle Z$ . Write answers as fractions AND decimals (3 decimal places).



$$\sin X = \frac{O}{H} = \frac{6}{10} = \frac{3}{5} = 0.6$$

$$\cos X = \frac{A}{H} = \frac{8}{10} = \frac{4}{5} = 0.8$$

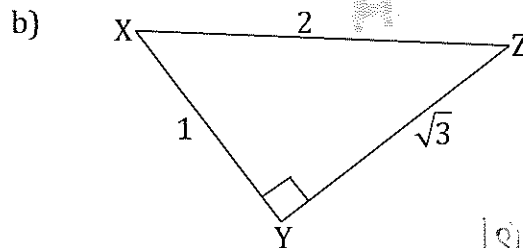
$$\tan X = \frac{O}{A} = \frac{6}{8} = \frac{3}{4} = 0.75$$

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$$\sin Z = \frac{O}{H} = \frac{8}{10} = \frac{4}{5} = 0.8$$

$$\cos Z = \frac{A}{H} = \frac{6}{10} = \frac{3}{5} = 0.6$$

$$\tan Z = \frac{O}{A} = \frac{8}{6} = \frac{4}{3} = 1.\bar{3}$$



$$\sin X = \frac{O}{H} = \frac{\sqrt{3}}{2} = 0.866$$

$$\cos X = \frac{A}{H} = \frac{1}{2} = 0.5$$

$$\tan X = \frac{O}{A} = \frac{\sqrt{3}}{1} = 1.73$$

$$\sin Z = \frac{O}{H} = \frac{1}{2} = 0.5$$

$$\cos Z = \frac{A}{H} = \frac{\sqrt{3}}{2} = 0.866$$

$$\tan Z = \frac{O}{A} = \frac{1}{\sqrt{3}} = 0.577$$

Now, to find trigonometric ratios, we could draw a triangle that had the appropriate angle and measure the proper sides. However, this would be time consuming, and inaccurate. Luckily, someone has already done these, and given them to us in the form of trigonometric charts (you have this built in to your scientific calculator). Therefore, you can use your calculator to find the Sine, Cosine, or Tangent of any angle you want.

**\*\*\* Note: Just make sure your calculator's angle is set to degrees. \*\*\***

Example: Find the appropriate ratio in decimal form to 3 decimal places:

a)  $\sin 30^\circ =$  0.5      b)  $\cos 15^\circ =$  0.966      c)  $\tan 55^\circ =$  1.428

d)  $\cos 88^\circ =$  0.035      e)  $\tan 45^\circ =$  1      f)  $\sin 75^\circ =$  0.966

